MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

PPH0255– PHYSICS

(Foundation in Information Technology)

23 OCTOBER 2017
9.00 A.M – 11.00 A.M
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 printed pages with 5 questions only, excluding the cover page physical constants and formula list.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

LIST OF PHYSICAL CONSTANTS

Acceleration due to gravity	g	$9.80\ \text{m/s}^2$
Electron mass	m_e	$9.11 \times 10^{-31}\ \text{kg}$
Proton mass	m_p	$1.67 \times 10^{-27}\ \text{kg}$
Elementary Charge	e	$1.602 \times 10^{-19}\ \text{C}$
Coulomb Constant	k	$9.0 \times 10^{9}\ \text{N m}^2.\ \text{C}^{-2}$
Permittivity of free space	ε_0	$8.85 \times 10^{-12}\ \text{C}^2\text{N}^{-1}.\text{m}^{-2}$

LIST OF FORMULA

NEWTONIAN MECHANICS

$$\omega = \frac{\Delta\theta}{\Delta t} \qquad v = r\omega \qquad a = r\alpha$$

$$\omega = \omega_o + \alpha t \qquad \theta = \frac{1}{2}(\omega_0 + \omega)t \qquad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha\theta \qquad \theta = \omega t - \frac{1}{2}\alpha t^2$$

$$W = Fs\cos\theta \qquad KE = \frac{1}{2}mv^2 \qquad PE_G = mgy$$

$$P = \frac{W}{t} = \frac{E}{t} = \frac{Fd}{t} = F\bar{v} \qquad p = mv \qquad \sum F = \frac{\Delta p}{\Delta t}$$

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2 \qquad m_1u_1 + m_2u_2 = (m_1 + m_2)\,v$$

ELECTRICITY

$q = Ne$

$F = k\frac{q_1 q_2}{r^2}$

$E = \frac{F}{q_o}$

$E = k\frac{q}{r^2}$

$\Phi = EA\cos\theta$

$\Phi_c = \frac{q_{in}}{\varepsilon_o}$

$V = \frac{U}{q_o}$

$V = \frac{kq}{r}$

$U = k\frac{q_1 q_2}{r_{12}}$

$C = \frac{\varepsilon_0 A}{d}$

$Q = CV$

$C = \kappa C_0$

$C_{eq} = C_1 + C_2 + \ldots.$

$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots.$

$V = E\,d$

$U = ½\,QV$

$U = ½\,CV^2$

$U = \frac{Q^2}{2C}$

$u_E = ½\,\varepsilon_o E^2$

$I_{av} = \frac{\Delta Q}{\Delta t}$

$V = IR$

$R = \rho\frac{L}{A}$

$R_{eq} = R_1 + R_2 + \ldots$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$

$P = IV$

$P = I^2 R$

$P = \frac{V^2}{R}$

$V = E - Ir$

STRUCTURED QUESTIONS [50 MARKS]

Instructions: Answer **ALL** questions in this section.

Question 1 [10 marks]

a. i. Define work done by a constant force. [1 mark]
ii. State the law of conservation of energy. [1 mark]

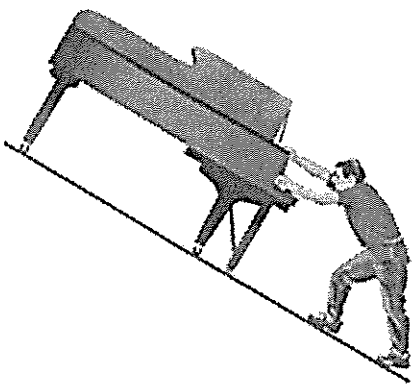

Figure 1

b. A 330 kg piano slides 3.6 meter down a 28° incline and is kept from accelerating (constant velocity) by a man who is pushing back on it parallel to the incline (**Figure 1**). The effective coefficient of kinetic friction is 0.40. Calculate the

i. force exerted by the man, [2 marks]

ii. work done by the man on the piano and [1 mark]

iii. work done by the force of gravity. [1 mark]

c. A 6.0 kg object moving in the $+x$ direction at 5.5 m/s collides head-on with an 8.0 kg object moving in the $-x$ direction at 4.0 m/s . Find the final velocity of each mass if

i. the 8.0 kg object is at rest after the collision. [1 mark]

ii. the 6.0 kg object has a velocity of 4.0 m/s in the $-x$ direction after the collision. [1 mark]

iii. Are the result in (i) and (ii) reasonable? Explain. [2 marks]

Continued.....

Question 2 [10 marks]

a. Express the following angles in radians.
   i. 45°
   ii. 360°
   Give as numerical values and as fractions of π [2 marks]

b. Find the period of a record that is rotating at 50 rpm. [2 marks]

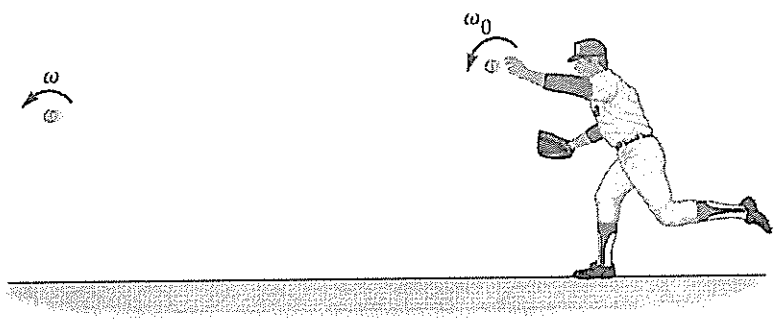

Figure 2

c. To throw a curve ball, a pitcher gives the ball an initial angular speed of 35.0 rad/s **(Figure 2).** When the catcher gloves the ball 0.5 s later, its angular speed has decreased (due to air resistance) to 33.0 rad/s.

   i. What is the ball's angular acceleration, assuming it to be constant? [2 marks]

   ii. How many revolutions does the ball make before being caught? [4 marks]

Question 3 [10 marks]

a. i. Define electric current [1 mark]
   ii. State Ohm's Law [1 mark]

b. A steady current of 2.5 A flows in a wire for 4.0 minutes.
   i. How much charge passed by any point in the circuit? [1 mark]

   ii. How many electrons would this be? [1 mark]

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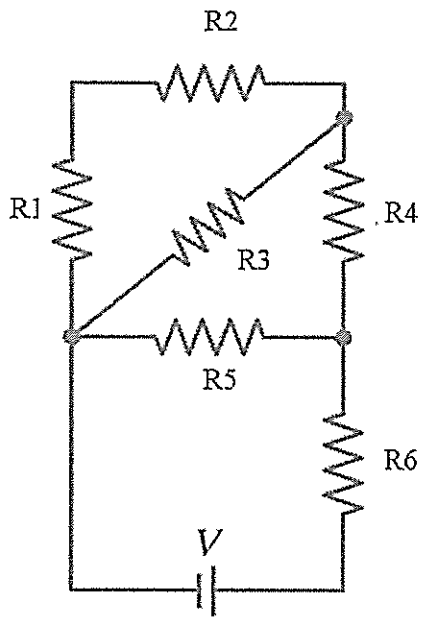

Figure 3

c. Six resistors are connected as in **Figure 3.**

i. Calculate the net resistance if each resistance has $R = 5\ k\Omega$. [5 marks]

ii. Calculate the current flows through R_6 if it is connected to a 12 V battery.

[1mark]

Question 4 [10 marks]

a. i. Define Coulomb's law [1 mark]
ii State Law of Charges. [1 mark]

b. Two charged balls are 15.0 cm apart. They are moved, and the force on each of them is found to have been tripled. How far apart are they now? [3 marks]

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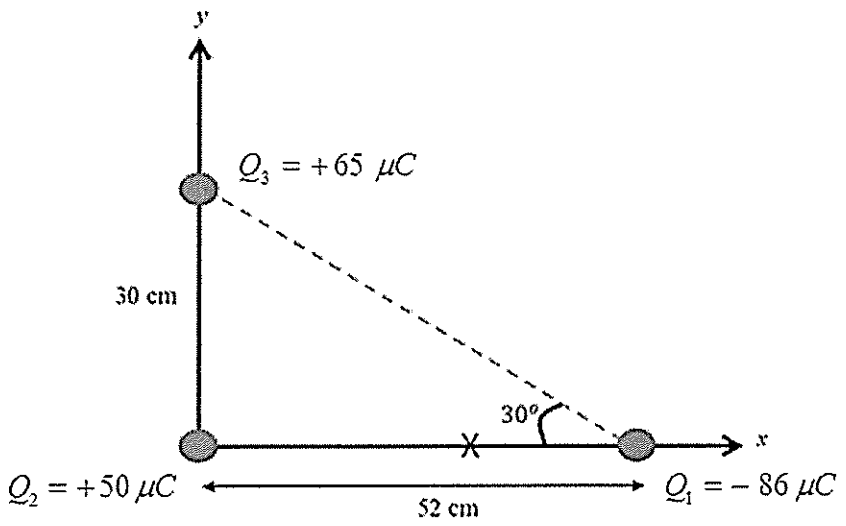

Figure 4

c. Three charged particles are arranged as shown in **Figure 4.** Calculate the net electrostatic force on $Q_3 = +65\ \mu C$ due to the charges Q_1 and Q_2

[5 marks]

Question 5 [10 marks]

a. Define *'free electrons'* and *'valence electrons'*. [2 marks]

b. With the aid of a diagram, describe the formation of holes in a *p*-types semiconductor. [3 marks]

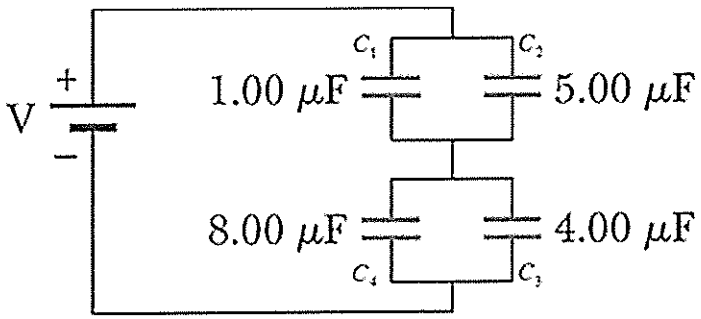

Figure 5

c. Find the charge on each of the capacitor in **Figure 5** when it is connected to a 12 V of battery. [5 marks]

End of Paper